MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

EEL2046 – ENERGY CONVERSION II

(LE)

06 MARCH 2020
9:00 AM – 11:00 AM
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question Paper consists of 3 pages including the cover page with 4 Questions only.

2. Answer **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print your answers in the Answer Booklet provided.

Question 1

a) A 6-pole dc generator has a lap wound armature containing 36 coils of 10 turns each. The flux per pole is 0.04Wb and it is running at a speed of 1000 rpm. What is the induced voltage of the machine? [4 Marks]

b) A 50-W, 250-V short-shunt compound generator has the following data: R_a = 0.05 Ω, R_{sr} = 0.05 Ω and R_f = 125 Ω. Calculate the induced armature voltage at rated load and terminal voltage. [5 marks]

c) A shunt generator 110kW, 230V has the armature and field resistances of 0.03ohm and 88ohm respectively.

i) Determine the power losses in the armature and field windings. What is the induced voltage in the armature? [10 Marks]

ii) Assume the shunt generator in the above Question 1 (c) has a total mechanical and core loss of 1.5kW, calculate the total loss of the generator. What is the power efficiency? [6 Marks]

Question 2

You as an engineer are required to design a cylindrical rotor DC Motor as shown in Figure 2. The design should be able to produced a North Pole at the left side and South Pole at the right side at the stator shoes as shown in Figure 2. Your are also required to design the DC Motor to turn the amature Clock-Wise (CW). Your are to re-draw the diagram in the answer booklet and fill in the appropriate labels on your DC Motor design. Find the following also:

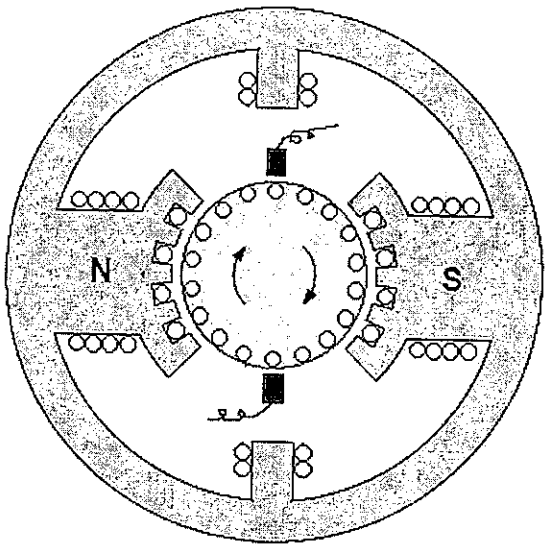

Figure Q2

Continued...

i) Name the four winding used in the Figure Q2 diagram and label them. [4 Marks]

ii) Indicate for all four winding conductors current directions for a successful DC Motor. (Note: conductor state into the page or out of the page and poles with N or S on the diagram in answer booklet) [4 Marks]

iii) Indicate the North and South poles generated in the armature and interpoles that satisfies a successful DC Motor. (Note: Indicate N or S in the diagram Figure Q2) [2 Marks]

iv) Indicate the magnetic field direction induced in all four winding conductors. (Note: Circulate the conductor magnetic field induced Clock-Wise or Counter-Clock Wise) [4 Marks]

v) Indicate and explain the Armature Reaction (AR) with aid of the Figure 2 and how this design of DC Motor helps to reduce the AR retaining Geometrical Neutral Axis (GNA) from Magnetic Neutral Axis (MNA) in the armature. [6 Marks]

vi) Indicate the Direct-Axis (d-axis) and Quadrature-Axis (q-axis) in a fresh re-drawn of diagram of Figure Q2 DC Motor and also draw the equivalent circuit of the DC Motor indicating the connections and its axis's. [5 Marks]

Question 3

a) Briefly explain the single-phase induction motors in terms of their starting and running characteristics and also rank them [10 marks]

b) A 4-pole, 3 phase 50Hz Y-connected squirrel cage induction motor runs at a speed of 1470 rpm at no load and at a speed of 1400 rpm at full load. Calculate the electrical frequency of rotor current at standstill, no load and full load conditions and the speed regulation of this motor. [15 marks]

Question 4

a) Explain the advantages and disadvantages of the Brushless DC Motor applications. [10 Marks]

b) With a simple sketch explain the constructional details and working principle of a Printed circuit board (or disk armature) motor. [10 marks]

c) A three-phase moving-rail Linear Induction Motor has three poles and a pole pitch of 0.24 m. The motor is operated from a 50 Hz system. Determine the rail speed in km/h if the slip of the motor is 16.7% [5 marks]

End of Paper